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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of	:	**Confirmation No. 6970**
Takahiro OSHITA et al.	:	Docket No. 01213/GEB667-US
Serial No.09/180,601	:	Group Art Unit 1764
Filed November 10, 1998	:	Examiner A. Doroshenk

FLUIDIZED-BED GASIFICATION METHOD
AND APPARATUS

APPELLANTS' BRIEF UNDER 37 CFR 1.192

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

The following is the Appellant's Brief, submitted in triplicate and in accordance with the provisions of 37 CFR 1.192.

1. REAL PARTY IN INTEREST.

The real party in interest is Ebara Corporation of Tokyo, Japan, the assignee of the present invention.

2. RELATED APPEALS AND INTERFERENCES.

There are no known related appeals or interferences.

3. STATUS OF CLAIMS.

Original claims 1-10 were cancelled and replaced by claims 11-24 in the amendment of September 25, 2000. Subsequently, claims 11 and 21 were cancelled, claims 12, 16, 20, and 22-24 were amended, and claims 25-28 were added in the amendment of August 31, 2001. Finally, claims 29 and 30 were added in the amendment of May 20, 2002. Thus, claims 12-20 and 22-30

are pending, and the rejection of these claims is appealed. A complete copy of the claims on appeal is provided in the Appendix.

4. STATUS OF AMENDMENTS.

No amendments subsequent to the Final Office Action of August 14, 2002 have been submitted.

5. SUMMARY OF THE INVENTION.

The present invention is directed to a two-stage treating method and apparatus in which *combustible gas* is generated at a controlled temperature in a first-stage fluidized-bed furnace, and then delivered to a second-stage melt combustion furnace for complete combustion, thereby producing exhaust gas. As used in this application, the term "combustible gas" means gas produced by heating or partial combustion of combustible waste materials (e.g., gasification) (see page 12, lines 22-28). The term "exhaust gas," on the other hand, means gas produced by complete combustion of combustible waste materials, which can be used to generate steam or drive a turbine, but which can not be used for combustion because it has already been completely burned (see page 3, lines 10-19). In contrast to the exhaust gas, the combustible gas has a high calorific value, and can be used as fuel or used for combustion in a second-stage melt combustion furnace, as in the present invention (see page 13, lines 20-27, and page 38, line 27 through page 39, line 8). Fig. 1 shows a gasifying apparatus 1 for conducting a gasification method of the present invention, and the method and apparatus will be described below with reference to this figure.

Combustible material (i.e., combustible waste material) F enters a fluidized-bed furnace 51 through a supply port 66 (see page 18, lines 7-11). A fluidized medium circulating within the fluidized-bed furnace 51 is heated and gasifies the combustible waste material (see page 13, lines 13-15). In this regard, the swirling circulation of the fluidized medium forms a gasifying zone G within the bed for gasification of the combustible waste materials, and an oxidizing zone S within the bed for oxidizing char and tar 114, which are difficult to oxidize. Specifically, in the oxidizing

zone S, the char and tar which are difficult to oxidize are combusted by a fluidizing gas having a relatively large oxygen content, and are partially oxidized (see page 13, lines 4-10 and 20-25). The swirling circulating flow of the fluidized medium diffuses the combustible waste materials throughout the fluidized-bed furnace so as to efficiently gasify and oxidize the combustibles, including the char. Thus, unreacted oxygen is prevented from ascending and oxidizing the generated combustible gas. As a result, because gasification of not only volatile material but also char is efficiently accomplished, the gasification efficiency is increased, and the fluidized-bed furnace produces high-quality combustible gas (see page 13, line 18 through page 14, line 6).

The fluidized-bed furnace 1 also has a heat recovery region 59 in which heat is recovered from the circulating fluidized medium so as to prevent the temperature of the fluidized medium (and, thus, the produced combustible gas) from increasing beyond a predetermined temperature (see page 16, line 18 through page 17, line 14). The generated combustible gas and non-combusted particles (i.e., char) 29 flow upward within the fluidized-bed furnace 51 toward the gas outlet 68. The combustible gas and non-combusted particles (char) 29 are then delivered through the gas outlet 68 to the melt combustion furnace 41 for complete combustion therein (see page 14, lines 16-28).

Gasifying combustible materials in a fluidized-bed furnace so as to produce combustible gas, and then delivering the combustible gas to a melt combustion furnace so as to burn the combustible gas and produce exhaust gas is an environmentally friendly and efficient waste treatment process, and helps reduce the amount of toxic materials produced by simple incineration. However, as explained on page 3, line 22 through page 4, line 15, the combustion of the combustible gas within the melt combustion furnace is highly sensitive to gas conditions and, particularly, the temperature of the gas. In the present invention, however, even if the combustible waste materials include plastics or similar materials with a high calorific value, the temperature of the fluidized-bed furnace and, particularly, the combustible gas produced within the fluidized-bed furnace can be maintained at a desired temperature (see page 17, lines 3-14). Thus, as explained above, the fluidized-bed furnace of the present invention produces temperature-controlled combustible gas, and delivers the combustible gas to a melt combustion

furnace at a temperature that is suitable to be fully combusted within the melt combustion furnace. Consequently, combustible waste materials can be treated in a highly efficient manner.

6. <u>ISSUES</u>.

The issue is whether claims 12-20 and 22-30 are unpatentable under 35 USC 103(a) as being obvious in view of the combination of Ohshita et. al., U.S. Patent No. 5,156,099 (the Ohshita reference) and Hirayama et. al., U.S. Patent No. 5,620,488 (the Hirayama reference).

7. <u>GROUPING OF CLAIMS</u>.

Claims 12-20, 25 and 26 stand or fall together, and do not stand or fall with claims 22-24 and 27-30.

Claims 22-24 and 27-30 stand or fall together, and do not stand or fall with claims 12-20, 25 and 26.

8. <u>ARGUMENT</u>.

<u>Claims 12-20, 25, and 26 Are Patentable Over the Prior Art</u>

Claims 12-20, 25, and 26, including independent claims 20 and 25, are directed to a method of treating combustibles. In particular, independent claims 20 and 25 recite that a fluidized medium is circulated within a fluidized-bed furnace so as to be heated. Combustible materials are gasified so as to generate *combustible gas* and non-combusted particles (char). Heat is recovered from the fluidized medium, and the combustible gas and non-combusted particles (char) are subsequently delivered to a melt combustion furnace and completely combusted in the melt combustion furnace.

In a non-final Office Action dated November 19, 2001, the Examiner asserted that the Ohshita reference discloses a fluidized-bed furnace apparatus including a combustion region for generating a combustible gas and particles, a heat recovery region, and a fluidized medium that is circulated within the fluidized-bed furnace. In this regard, the Examiner asserts that column 7,

lines 58-67 of the Ohshita reference teach the combustion region that generates combustible gas and particles.

In the remarks in support of the amended claims filed on May 20, 2002, the Applicants explained that the present invention is directed to a two-stage fluidized-bed gasification method and apparatus, in which *combustible gas* is generated at a controlled temperature. In contrast, however, it was further explained that the Ohshita reference discloses a fluidized-bed boiler in which coal or waste materials are *completely* combusted in a fluidized bed so as to produce *exhaust gas*. In particular, it was pointed out to the Examiner that column 7, lines 50-53 of the Ohshita reference explain that "even coal with a high fuel ratio can be *completely burnt*" (emphasis added).

Nonetheless, in the final Office Action of August 14, 2002, the Examiner maintained the rejections while acknowledging the Applicants' argument that the Ohshita reference does not disclose a furnace that produces a "combustible gas", but rather an "exhaust gas." In this regard, the Examiner asserted that simply because the Ohshita reference teaches that the fuel "can" be completely burned does not preclude that the fuel *not* be completely burned. In addition, the Examiner also asserted that the Ohshita reference teaches that the gas exiting the fluidized bed furnace is a "combustible gas", and refers to column 3, lines 27-30.

As an initial matter, assuming the validity of the Examiner's position that the Ohshita reference does not preclude that the fuel *not* be completely burned (i.e., that the Ohshita reference does not teach *away* from the complete burning of the fuel), it is not seen how this fact would *motivate* one of ordinary skill in the art to generate combustible gas. In other words, the lack of a teaching in a reference *against* an element of the claimed invention does not mean that the reference actually does teach that element.

Moreover, it is submitted that the Examiner's position is, in fact, not valid, and that the Examiner appears to be making a strained interpretation of the Ohshita reference. With regard to the "can be completely burnt" phrase from column 7, line 53, it appears that the Examiner interprets this phrase as teaching that it is acceptable to not completely burn the combustible waste material. In contrast, it is submitted that the correct interpretation of this phrase, when

viewed in the context of the entire Disclosure of the Ohshita reference, is that the furnace of the Ohshita reference will *completely burn* even fuels with a high fuel ratio, such as coal. In this regard, the Ohshita reference clearly indicates that *exhaust gas* (i.e., gas formed from *complete* combustion, as defined in the present application) is discharged from the boiler and guided to the cyclone 7 in the paragraph immediately following the above-referenced phrase (see column 7, line 58 through column 8, line 6.

Despite the Examiner's apparent assertions to the contrary (see top of page 4 of the Final Office Action of August 14, 2002), the term "combustible gas" is <u>not</u> found anywhere in the Ohshita reference. In fact, the term "exhaust gas" is used almost exclusively in the Ohshita reference to refer to the gas produced by combustion in the furnace (see, for example, column 3, lines 39-42; column 8, lines 19-21; and column 9, lines 56-57), thereby indicating that the furnace of the Ohshita reference can perform only *complete* combustion. Furthermore, Figs. 1-3 of the Ohshita reference include an arrow indicating the flow path of the *exhaust gas* and char leaving the boiler body 1 and entering the cyclone 7. As clearly indicated in these figures, solid particles that have not been completely combusted are introduced into a hopper and fed back into the boiler body by a screw feeder 11, 31, 51 (see column 7, line 59 through column 8, line 6). The Ohshita reference further discloses that after the exhaust gas has passed through the cyclone 7, it is discharged into the atmosphere (see column 11, line 57). Because it is unlikely that combustible gas from partial burning would be discharged into the atmosphere due to environmental, safety, and efficiency concerns, this portion of the disclosure provides further evidence that the furnace of the Ohshita reference produces only *exhaust* gas produced from complete combustion.

In view of the above, it is submitted that the Ohshita reference <u>does not</u> disclose or even suggest gasifying combustibles in a fluidized-bed furnace while circulating a fluidized medium therein so as to generate combustible gas and non-combusted particles for delivery to a melt combustion furnace. Furthermore, it is submitted that the Ohshita reference does not disclose or suggest using the gas generated in the furnace as a fuel for combustion in a melt combustion furnace because, as explained above, the exhaust gas produced by the furnace of the Ohshita reference can not be further combusted or used as fuel.

Although the Hirayama reference discloses gasifying combustibles in a fluidized-bed furnace while circulating a fluidized medium therein to generate combustible gas, this reference does not disclose recovering heat from the fluidized medium when generating the combustible gas. As explained above, recovering heat during generation of the combustible gas is important for safe and efficient subsequent combustion of the combustible gas in a melt combustion furnace. Furthermore, contrary to the Examiner's assertion in the Advisory Action of December 26, 2002, the Hirayama reference also does not disclose or suggest that *exhaust gas* is capable of being combusted. In contrast, column 5, lines 45 through 61 of the Hirayama reference explains that the combustible gas can be completely burned to generate *exhaust gas*, which can then be used to drive a gas turbine (as explained above), but does not state that exhaust gas can be combusted.

Therefore, since neither the Hirayama reference nor the Ohshita reference disclose or suggest gasifying combustibles in a fluidized-bed furnace while recovering heat therefrom to generate a combustible gas, or disclose delivery of the generated combustible gas to a melt combustion furnace for complete combustion therein, one of ordinary skill in the art would not be motivated by the Hirayama reference to modify the Ohshita reference or to combine the references so as to obtain the invention recited in independent claims 20 and 25. Accordingly, it is respectfully submitted that independent claims 20 and 25, and the claims that depend therefrom, are clearly patentable over the prior art of record.

Claims 22-24 and 27-30 Are Patentable Over the Prior Art

Claims 22-24 and 27-30, including independent claims 24, 27, and 29, are directed to an apparatus for treating combustibles. In particular, independent claims 24, 27, and 29 recite that the apparatus comprises a fluidized-bed furnace having a region for *gasifying combustibles so as to generate combustible gas* and non-combusted particles (char), having *a heat recovery region*, and having a fluidized medium operable to circulate within the fluidized-bed furnace. A heat recovery surface in the fluidized-bed furnace recovers heat from the fluidized medium, and a melt

combustion furnace receives and combusts the combustible gas and the non-combusted particles (char) generated by the fluidized-bed furnace.

As explained above, the Ohshita reference discloses a furnace that produces only fully-combusted *exhaust gas*. Thus, the Ohshita reference does not disclose or suggest a fluidized-bed furnace with a heat recovery surface for gasifying combustibles so as to generate *combustible gas* and non-combusted particles (char), and a melt combustion furnace for receiving and combusting the combustible gas and the non-combusted particles (char). Furthermore, as also explained above and acknowledged by the Examiner, the Hirayama reference also does not disclose or suggest a fluidized-bed furnace with a heat recovery surface for generating combustible gas and non-combusted particles, and having a melt combustion furnace for receiving and combusting the combustible gas and the non-combusted particles. Therefore, one of ordinary skill in the art would not be motivated by the Hirayama reference to modify the Ohshita reference or to combine the references so as to obtain the invention recited in independent claims 24, 27 or 29. Accordingly, it is respectfully submitted that independent claims 24, 27, and 29, and the claims that depend therefrom, are clearly patentable over the prior art of record.

Conclusion

In view of the above, it is submitted that claims 12-20 and 22-30 are patentable over the prior art of record, including the combination of the Ohshita reference and the Hirayama reference. Accordingly, the Board is respectfully requested to reverse the rejections set forth in the Final Office Action of August 14, 2002.

This brief is submitted in triplicate with the requisite fee of $320.00.

Respectfully submitted,

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9. APPENDIX: Claims Pending on Appeal - Serial No. 09/180,601.

12. A method as claimed in claim 20, wherein said combustion region and said heat recovery region are separated by a partition wall and are connected above and below said partition wall, said combustion region includes first and second areas adjacent to each other, and further comprising:

supplying a first fluidizing gas as an upward flow into said first area, supplying a second fluidizing gas as an upward flow into said second area, and supplying heat recovery region fluidizing gas to said heat recovery region;

controlling a mass flow of said first fluidizing gas to be smaller than a mass flow of said second fluidizing gas to create in said first area a moving bed where said fluidized medium descends and is dispersed and to create in said second area a fluidized bed where said fluidized medium is fluidized, whereby said combustibles are gasified into a combustible gas in said combustion region while circulating therein with said fluidized medium; and

flowing said fluidized medium from said combustion region over said partition wall into said heat recovery region, and returning said fluidized medium in said heat recovery region to said combustion region; and

said controlling comprises adjusting said supplying said heat recovery region fluidizing gas to said heat recovery region.

13. A method as claimed in claim 12, further comprising regulating a temperature in said fluidized-bed furnace.

14. A method as claimed in claim 13, wherein said regulating comprises, as a primary temperature control, controlling a temperature in said combustion region by adjusting said supplying said first fluidizing gas to said first area and said supplying said second fluidizing gas to said second area, and, as an auxiliary temperature control, controlling a temperature in said heat

recovery region by said adjusting said supplying said heat recovery region fluidizing gas to said heat recovery region.

15. A method as claimed in claim 13, wherein said regulating comprises, as an auxiliary temperature control, controlling a temperature in said combustion region by adjusting said supplying said first fluidizing gas to said first area and said supplying said second fluidizing gas to said second area, and, as a primary temperature control, controlling a temperature in said heat recovery region by said adjusting said supplying said heat recovery region fluidizing gas to said heat recovery region.

16. A method as claimed in claim 20, wherein said fluidized-bed furnace has a substantially circular cross-sectional shape, said combustion region comprises a circular central region, said heat recovery region comprises an outer peripheral region, said combustion region and said heat recovery region are separated by a partition wall and are connected above and below said partition wall, said combustion region includes central and peripheral areas adjacent to each other, and further comprising:

supplying a central fluidizing gas as an upward flow into said central area, supplying a peripheral fluidizing gas as an upward flow into said peripheral area, and supplying heat recovery region fluidizing gas to said heat recovery region;

controlling a mass flow of one of said central fluidizing gas and said peripheral fluidizing gas to be smaller than a mass flow of the other of said peripheral fluidizing gas and said central fluidizing gas, to create in one of said central area and said peripheral area a moving bed where said fluidized medium descends and is dispersed and to create in the other of said peripheral area and said central area a fluidized bed where said fluidized medium is fluidized, whereby said combustibles are gasified into a combustible gas in said combustion region while circulating therein with said fluidized medium; and

flowing said fluidized medium from said combustion region over said partition wall into said heat recovery region, and returning said fluidized medium in said heat recovery region to said combustion region; and

said controlling comprises adjusting said supplying said heat recovery region fluidizing gas to said heat recovery region.

17. A method as claimed in claim 16, further comprising regulating a temperature in said fluidized-bed furnace.

18. A method as claimed in claim 17, wherein said regulating comprises, as a primary temperature control, controlling a temperature in said combustion region by adjusting said supplying said central fluidizing gas to said central area and said supplying said peripheral fluidizing gas to said peripheral area, and, as an auxiliary temperature control, controlling a temperature in said heat recovery region by said adjusting said supplying said heat recovery region fluidizing gas to said heat recovery region.

19. A method as claimed in claim 17, wherein said regulating comprises, as an auxiliary temperature control, controlling a temperature in said combustion region by adjusting said supplying said central fluidizing gas to said central area and said supplying said peripheral fluidizing gas to said peripheral area, and, as a primary temperature control, controlling a temperature in said heat recovery region by said adjusting said supplying said heat recovery region fluidizing gas to said heat recovery region.

20. A method of treating combustibles, said method comprising:

circulating a fluidized medium between a combustion region and a heat recovery region within a bed of a fluidized-bed furnace such that said fluidized medium is heated in said combustion region;

gasifying combustibles in said combustion region of said fluidized-bed furnace, thus generating combustible gas and non-combusted particles;

recovering heat from said fluidized medium in said heat recovery region of said fluidized-bed furnace after said fluidized medium has been heated in said combustion region, so as to thereby control a temperature of said bed; and

delivering said combustible gas and non-combusted particles to a melt combustion furnace and therein combusting said combustible gas and melting non-combustible ash of said non-combusted particles.

22. An apparatus as claimed in claim 24, wherein said combustion region and said heat recovery region are separated by a partition wall, said combustion region includes first and second areas adjacent to each other, and further comprising:

an air diffusion device to supply a first fluidizing gas as an upward flow into said first area, to supply a second fluidizing gas as an upward flow into said second area, and to supply heat recovery region fluidizing gas to said heat recovery region, said air diffusion device being structured such that a mass flow of said first fluidizing gas is smaller than a mass flow of said second fluidizing gas to create in said first area a moving bed where said fluidized medium descends and is dispersed and to create in said second area a fluidized bed where said fluidized medium is fluidized, whereby said combustibles are gasified into a combustible gas in said combustion region while circulating therein with said fluidized medium; and wherein

said combustion region and said heat recovery region are connected above and below said partition wall, to allow said fluidized medium from said combustion region to flow over said partition wall into said heat recovery region;

said heat recovery surface comprises a member in said heat recovery region for a medium to pass therethrough; and

said air diffusion device includes a heat recovery region air diffuser at a bottom of said heat recovery region, said heat recovery air diffuser being structured to adjust the supply of said

heat recovery region fluidizing gas to said heat recovery region to cause said fluidized medium in said heat recovery region to descend therein as a moving bed and to circulate therefrom below said partition wall back to said combustion region.

23. An apparatus as claimed in claim 24, wherein said fluidized-bed furnace has a substantially circular cross-sectional shape, said combustion region comprises a circular central region, said heat recovery region comprises a peripheral region, said combustion region and said heat recovery region are separated by a partition wall, said combustion region includes central and peripheral areas adjacent to each other, and further comprising:

an air diffusion device to supply a central fluidizing gas as an upward flow into said central area, to supply a peripheral fluidizing gas as an upward flow into said peripheral area, and to supply heat recovery region fluidizing gas to said heat recovery region, said air diffusion device being structured such that a mass flow of one of said central fluidizing gas and said peripheral fluidizing gas is smaller than a mass flow of the other of said peripheral fluidizing gas and said central fluidizing gas to create in one of said central area and said peripheral area a moving bed where said fluidized medium descends and is dispersed and to create in the other of said peripheral area and said central area a fluidized bed where said fluidized medium is fluidized, whereby said combustibles are gasified into a combustible gas in said combustion region while circulating therein with said fluidized medium; and wherein

said combustion region and said heat recovery region are connected above and below said partition wall, to allow said fluidized medium from said combustion region to flow over said partition wall into said heat recovery region;

said heat recovery surface comprises a member in said heat recovery region for a medium to pass therethrough; and

said air diffusion device includes a heat recovery region air diffuser at a bottom of said heat recovery region, said heat recovery air diffuser being structured to adjust the supply of said heat recovery region fluidizing gas to said heat recovery region to cause said fluidized medium in

said heat recovery region to descend therein as a moving bed and to circulate therefrom below said partition wall back to said combustion region.

24. An apparatus for treating combustibles, said apparatus comprising:

a fluidized-bed furnace including a bed having a combustion region for gasifying combustibles so as to generate combustible gas and non-combusted particles, and having a heat recovery region, said fluidized-bed furnace further including a fluidized medium operable to circulate between said combustion region, whereat said fluidized medium is heated, and said heat recovery region;

a heat recovery surface in said heat recovery region for recovering heat from said fluidized medium after said fluidized medium has been heated in said in said combustion region, so as to thereby control a temperature of said bed; and

a melt combustion furnace for receiving the combustible gas and the non-combusted particles and for combusting the combustible gas and melting non-combustible ash of the non-combusted particles.

25. A method of treating combustibles, said method comprising:

circulating a fluidized medium between a combustion region and a heat recovery region within a bed of a fluidized-bed furnace such that said fluidized medium is heated in said combustion region;

gasifying combustibles in said combustion region, thus generating combustible gas and non-combusted particles;

recovering heat from said fluidized medium after said fluidized medium has been heated in said combustion region; and

delivering said combustible gas and non-combusted particles to a melt combustion furnace and therein combusting said combustible gas and melting non-combustible ash of said non-combusted particles.

26. A method as claimed in claim 25, further comprising maintaining said bed of said fluidized-bed furnace at a temperature of 450°C to 800°C, and wherein said melting of said non-combustible ash of said non-combustible particles is conducted at a temperature of at least 1300°C.

27. An apparatus for treating combustibles, said apparatus comprising:

a fluidized-bed furnace including a bed having a combustion region for gasifying combustibles so as to generate combustible gas and non-combusted particles, and having a heat recovery region, said fluidized-bed furnace further including a fluidized medium operable to circulate between said combustion region and said heat recovery region;

a heat recovery surface in said heat recovery region for recovering heat from said fluidized medium after said fluidized medium has been heated in said combustion region; and

a melt combustion furnace for receiving the combustible gas and the non-combusted particles and for combusting the combustible gas and melting non-combustible ash of the non-combusted particles.

28. An apparatus as claimed in claim 27, wherein said heat recovery surface is operable to recover heat from said fluidized medium so as to maintain said bed of said fluidized-bed furnace at a temperature of 450°C to 800°C, and wherein said melt combustion furnace is operable to melt said non-combustible ash of said non-combustible particles at a temperature of at least 1300°C.--

29. An apparatus for treating combustibles, said apparatus comprising:

a fluidized-bed furnace having a gasification region for gasifying combustibles so as to generate combustible gas and non-combusted particles, and having a heat recovery region, said fluidized-bed furnace further including a fluidized medium operable to circulate between said gasification region and said heat recovery region;

a heat recovery surface in said heat recovery region for recovering heat from said fluidized medium; and

a melt combustion furnace for receiving the combustible gas and the non-combusted particles and for combusting the combustible gas and melting non-combustible ash of the non-combusted particles.

30. An apparatus as claimed in claim 29, wherein said heat recovery surface is operable to recover heat from said fluidized medium so as to maintain said fluidized-bed furnace at a temperature of 450°C to 800°C, and wherein said melt combustion furnace is operable to melt said non-combustible ash of said non-combustible particles at a temperature of at least 1300°C.